

Box and and Scatter Plots

Box Plots

Have students display data by creating box plots.

How About a Box Plot?


Box Plots

< >

By Brainiaccamp Math Software

<https://www.youtube.com/watch?v=CoVf1jLxgj4>

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Let's Create a Box Plot

- Arrange data in order and divide into quarters
- Find the median of the data set

10	11	11	15	15	15	16	16	16	17	17	19	20	21	21	21	21	22	23	23	25	26	27	29
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Median

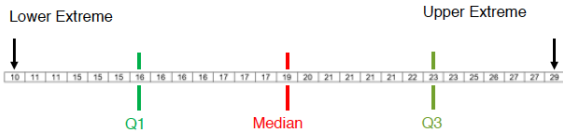
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Let's Create a Box Plot

Find the middle value (Q3) of the lower quartile and the upper quartile

Find the extreme values of the data set

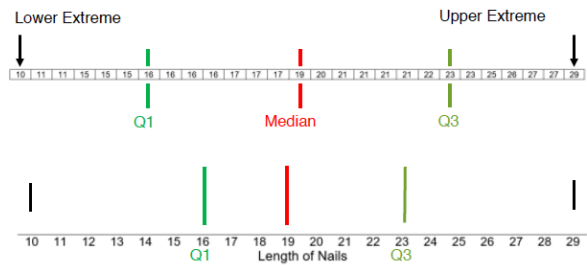


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Let's Create a Box Plot

We now draw a number line to plot all the numbers we identified.

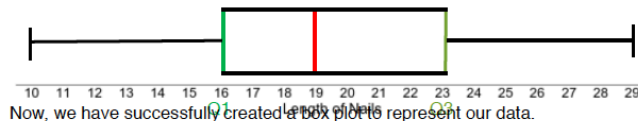


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Let's Create a Box Plot

The last step is to draw a box from Q1 to Q3 and lines connecting the extreme values to our box.



Now, we have successfully created a box plot to represent our data.

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The GEDTS® consultants recommend showing students the following video to understand box plots. <https://www.youtube.com/watch?v=CoVf1jLxgj4>

Tips:

- Provide students an easy set of data.
 - Ex: Check their heart rate after so many minutes of exercise
- Model how to think aloud through determining how to read and display the data.
- Create a model.
- Ask students to display the data in a different way.
- Provide students another set of data.
- Ask them how they would display it.

Debrief by analyzing the thinking behind displaying data.

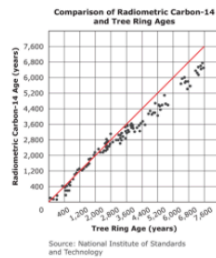
- What pattern do you see?
- What does this graph tell you?
- Who could use this data?
- In what ways may they use it?
- Why is this data shown in a line graph, box graph, scatter plot, etc.?

Scatter Plots

Scatter Plots are used frequently in displaying scientific data (i.e., cause and effect, correlation, etc).

The Basics of Scatter Plots

- Are similar to line graphs
- Have horizontal and vertical axes
- Have two sets of data that are plotted as ordered pairs on a coordinate to show the relationship
- Show how much one variable is affected by another – the correlation

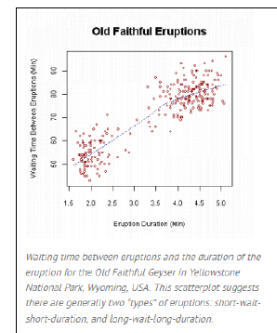


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The Vocabulary of Scatter Plots

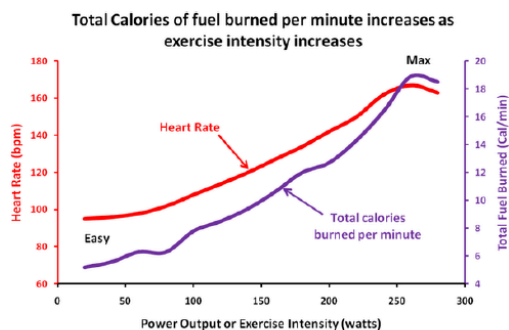
- Bivariate data
- Independent variable
- Dependent variable
- Line of best fit
- Correlation
 - Positive
 - Negative
 - No
- Causation



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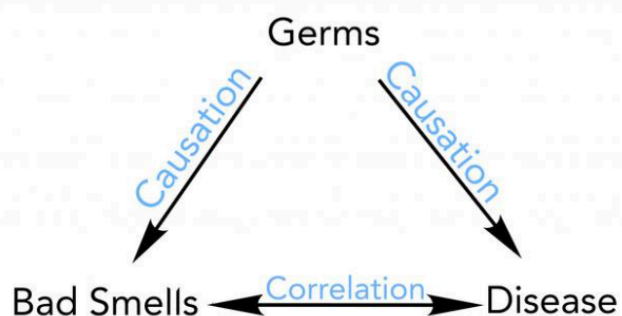
Causation



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However, correlation does not always imply causation



Correlation vs. Causation

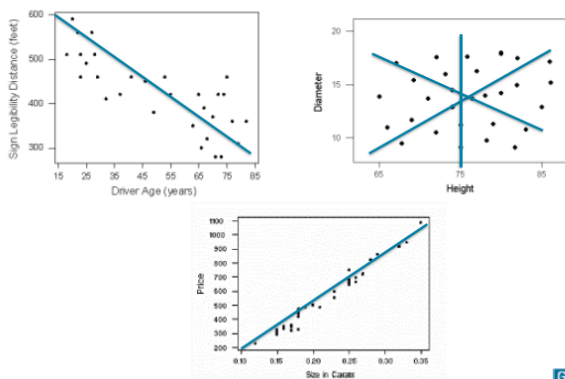
Correlation

- Measures the relationship between two things
- Tells us that two variables are related, but we cannot say anything about whether one caused the other

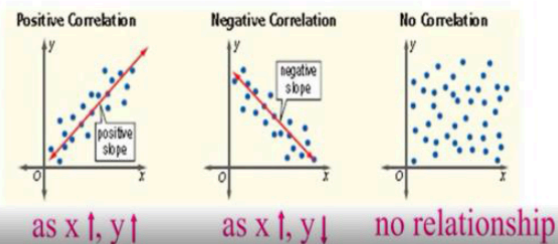
Causation

- Any cause that produces an effect
- Tells us when something happens (cause), something else will also always happen(effect).

Scatter Plots



It's Just Makes Sense!

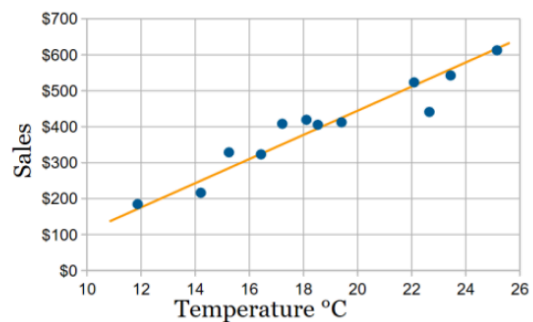


Let's Look at a Real-Life Example

The local ice cream shop keeps track of how much ice cream they sell versus the noon temperature on that day. Here are their figures for the last 12 days.

Temperature °C	Ice Cream Sales
14.2°	\$215
16.4°	\$325
11.9°	\$185
15.2°	\$332
18.5°	\$406
22.1°	\$522
19.4°	\$412
25.1°	\$614
23.4°	\$544
18.1°	\$421
22.6°	\$445
17.2°	\$408

Let's Look at a Real-Life Example



Add a Formula – Celsius to Fahrenheit

The Temperature Conversion Formula from Celsius to Fahrenheit is,

$$F = C\left(\frac{9}{5}\right) + 32$$

$$F = 14\left(\frac{9}{5}\right) + 32 = 57.2$$

$$F = 14(1.8) + 32 = 57.2$$

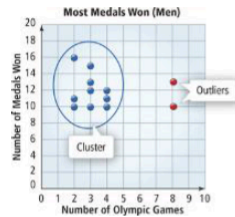
$$F = 25.1(1.8) + 32 = 77.2$$

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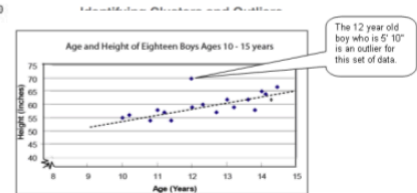


Clusters and Outliers



A **cluster** is formed when several data points lie in a small interval.

An **outlier** has a value that is much greater or much less than other data in the set.



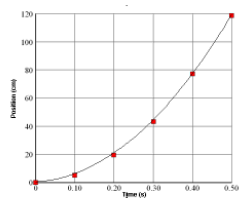
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Date obtained from www.public.dcu.ie/~edu



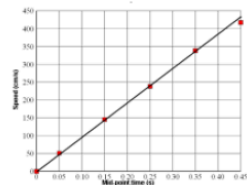
Scientific Graphs



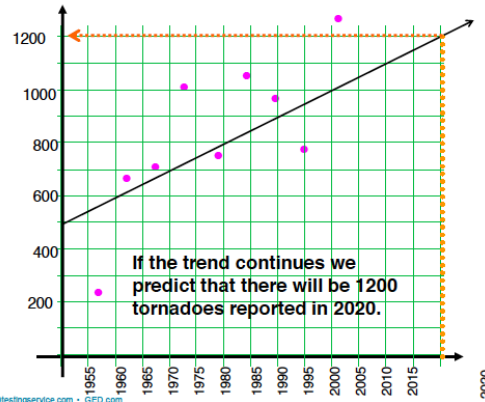
Many scientific graphs are made as **line graphs**.

The lines on scientific graphs are often drawn either **straight** or **curved**. These lines do not have to touch all the data points, but they should at least get close to most of them. They are called **best-fit lines**.

Often, scientific graphs are not drawn in connect-the-dot fashion.



Use the line of best fit to predict how many tornadoes may be reported in the United States in 2020 if the trend continues.



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Apply it with Students

For the complete lesson, see: <https://www.yummymath.com/2013/do-teams-that-spend-a-lot-win-a-lot/> (Links to an external site.)Links to an external site.. You must join free as a member to receive the documents in a WORD file.

Combinations and Permutations

Combinations and Permutations are important to understand in order to be able to understand probability, a key concept of statistical data.

It begins with basic counting principles. Read <http://www.mathsisfun.com/data/basic-counting-principle.html> to review basic counting principles.

Combinations and Permutations involve common counting principles.

Watch the following video on Combinations and Permutations:

https://www.youtube.com/watch?v=j_863d3QWvs

Please read the following explanations of factorials, combinations, and permutations by Math is Fun Advanced.

<http://www.mathsisfun.com/numbers/factorial.html>

<http://www.mathsisfun.com/combinatorics/combinations-permutations.html>

Probability, Central Tendency, and Standard Deviation


Probability

1. Watch the following video <https://www.youtube.com/watch?v=uzkc-qNVok&list=PLC58778F28211FA19>
2. Go to <http://www.mathsisfun.com/data/probability.html> and complete 5 of the practice questions and view “An Experiment with a Die and Experiment with Dice “at the bottom of the page.

Measures of Central Tendency

Go to: <http://www.mathsisfun.com/data/index.html> and review the following pages:
(OPTIONAL: Test your skills by answering a couple of the questions in each section. Complete as many of the application activities that you have time to complete).

Measures of Central Value

- [Finding a Central Value](#)
- [Calculate the Mean Value](#) and [The Mean Machine](#)
- [Find the Median Value](#)
- [Find the Mode or Modal Value](#)
-  [Activity: Averages Brain-Teaser](#)
- [Calculate the Mean from a Frequency Table](#)
- [Advanced: Mean, Median and Mode from Grouped Frequencies](#)

Standard Deviation

Go to: <http://www.mathsisfun.com/data/index.html> and review the following pages: (Complete as many of the application activities that you have time to complete).

Measures of Spread

- [The Range](#)
- [Quartiles and the Interquartile Range](#)
- [Percentiles](#)
- [Mean Deviation](#)
- [Standard Deviation](#)
- [Standard Deviation Calculator](#)
- [Standard Deviation Formulas](#)

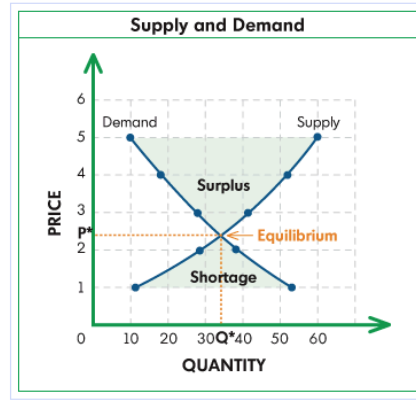
The following are examples of test questions that are similar to what may be seen on the GED® that require knowledge and skills regarding the use of data. These questions are taken from <http://www.gedpracticequestions.com/>. You may access these for free. They will provide you with the correct answer and provide feedback on each answer.

As you review the examples of GED® test questions below, ask:

1. What statistical data analysis knowledge and skills is needed to answer the question?
What other knowledge and skills are needed?
2. What question may you add that would require the knowledge and skills of statistics? (a question regarding probability, central tendency, standard deviation?)

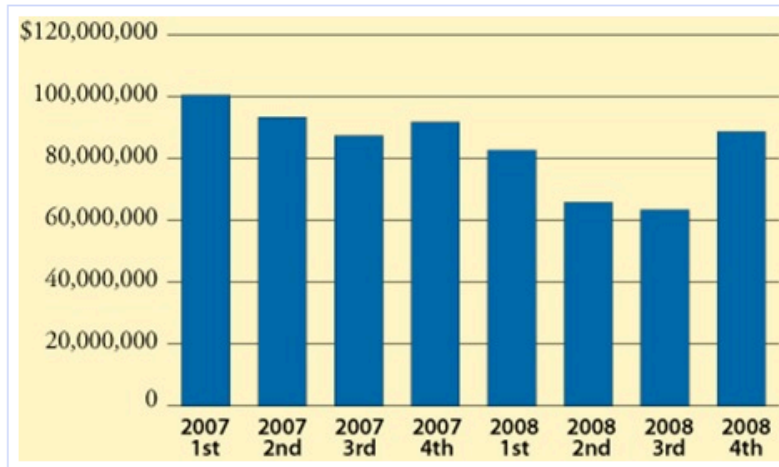
3. How may you instruct your students to read and interpret the graph/chart using the resources provided while incorporating some of your own strategies and resources?

Social Studies



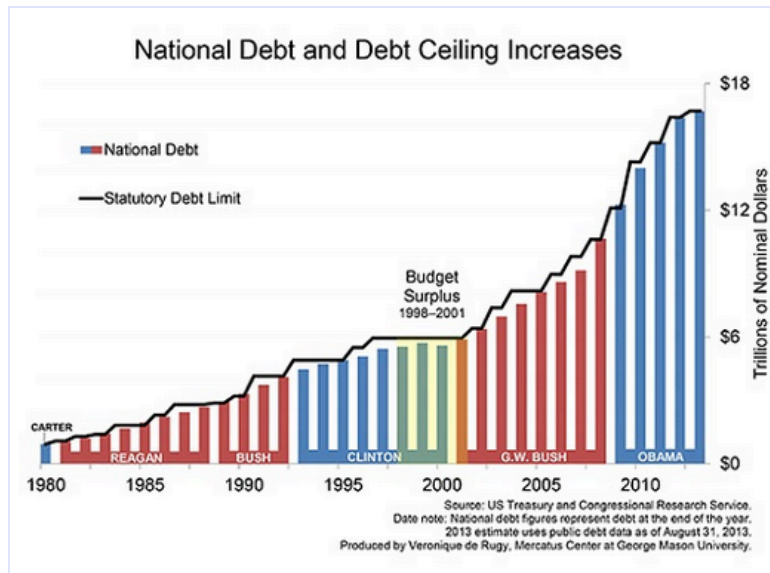
Which of the following statements is NOT true about this graph?

- A** The equilibrium price is less than 3.
- B** The quantity demanded will increase with lower prices.
- C** A surplus will occur if 20 units are supplied at a price of 4.50.
- D** The quantity supplied will increase with lower prices.



Based on this chart of corporate earnings, in how many quarters did the company's gross earnings change by more than \$10 million?

- A** 0
- B** 1
- C** 2
- D** 4



Which of these conclusions is supported by this graph?

- A** The statutory debt limit helps reduce debt.
- B** Total debt will exceed \$18 Trillion in a few years.
- C** Total debt has increased during the terms of the last 5 presidents.
- D** Current levels of debt are not sustainable.

Science

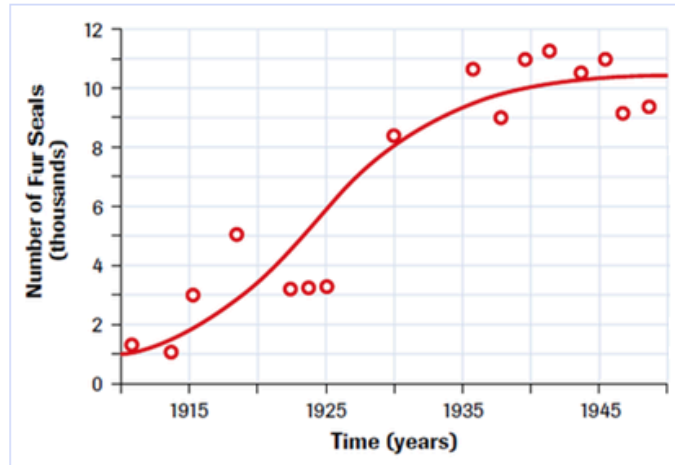
Students are researching families with one brown-haired parent and one red-haired parent to understand how recessive hair-color genes interact with dominant genes. They studied the offspring of a heterozygous brown-haired man (Bb) and a homozygous recessive red-haired woman (bb). Of their four children, three have brown hair and one has red hair. The students prepared the Punnett square that is shown below.

	B	b
b		
b		

If the couple has another child, what is the probability that this child will have brown hair?

- A** 0%
- B** 25%
- C** 50%
- D** 75%

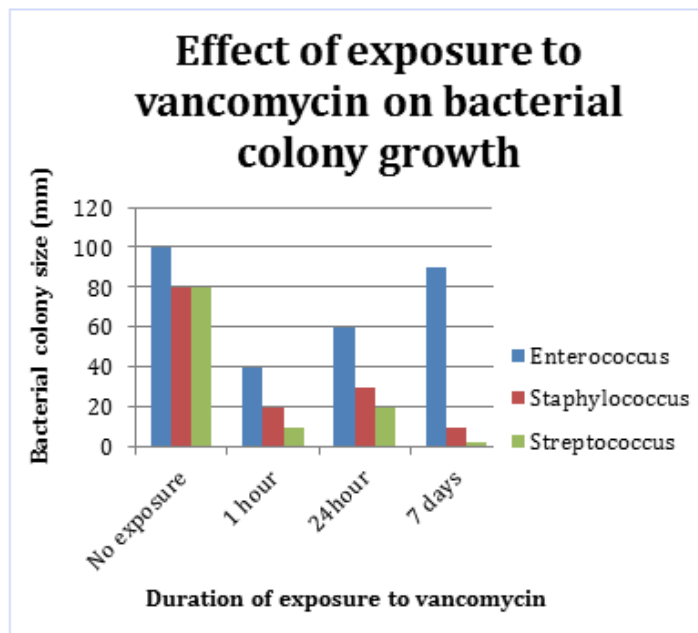
The graph below shows the population of fur seals on one of the Pribilof Islands, a group of volcanic islands near the coast of Alaska. Scientists believe that fur seals first arrived on this island in the year 1902. The red circles are population estimates and the red line is the population trend line.



What is the island's approximate carrying capacity for fur seals?

- A** 6,000
- B** 10,500
- C** 11,500
- D** 1,500

A study was done to measure the effectiveness of an antibiotic on different bacteria. The antibiotic Vancomycin was tested on 3 types of bacteria: *Enterococcus*, *Staphylococcus*, and *Streptococcus*. Bacterial growth was measured at 3 different durations of time exposure to the antibiotic: 1 hour, 24 hours, and 7 days. The rate of bacterial growth was measured by bacterial colony size at each time interval. The data for each duration was calculated and compiled into the graph shown below. As a control, each bacteria species was also grown with no exposure to the antibiotic. This control culture was measured after 7 days.



- A** The independent variable is the duration of exposure to Vancomycin; the dependent variable is bacterial colony size.
- B** The independent variable is the bacterial colony size; the dependent variable is the duration of exposure to Vancomycin.
- C** The independent variable is the bacterial colony size; the dependent variable is the type of bacteria.
- D** The independent variable is the duration of exposure to Vancomycin; the dependent variable is the type of bacteria.

